

New species of Paleogene cypraeoideans (Gastropoda) from the Pacific slope of North America

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ABSTRACT

A new species of *Bernaya* sensu stricto (Cypraeidae) from Eocene rocks of Washington and four new species of *Eocypraea* sensu stricto (Eocypraeidae), one from Paleocene strata of northern California, two from Eocene strata of Washington, and one from Baja California Sur, Mexico, are described. The new species of *Bernaya* sensu stricto and the Washington species of *Eocypraea* sensu stricto represent the northernmost Cenozoic records for their respective genera in western North America. A tentative record of *Eocypraea* (*Eocypraea*) *inflata* (Lamarck, 1802), previously known only from the Lutetian Stage (middle Eocene) of France, Belgium, and England, is noted from the middle Eocene Domengine Formation of Kings County, California.

Additional keywords: *Bernaya*, *Eocypraea*, fossils, paleontology, Paleocene, Eocene

INTRODUCTION

Five new species of Paleogene cypraeoideans are described from localities on the Pacific slope of North America (Table 1). The new species of *Bernaya* sensu stricto represents the first record of this genus from Washington and is the northernmost record of the genus in western North America. Four new species of *Eocypraea* sensu stricto are described from strata in Lake County, California, Thurston and Lewis counties, Washington, and Baja California Sur, Mexico. All four species represent first records from their respective regions and the species from Washington are the northernmost representatives of the genus in western North America. These taxa are indicators of shallow, warm water depositional environments.

STRATIGRAPHY AND GEOLOGIC AGES

The formations listed below, from oldest to youngest, are those from which the new species are described. Because these formations have been mentioned by previ-

ous authors, only a brief overview of the stratigraphic nomenclature and age will be mentioned. Readers will be referred to additional sources for detailed descriptions.

MARTINEZ FORMATION

Whitney in Gabb (1869: xiii) provisionally proposed the Martinez Group to “include a series of beds, of small geographical extent, found at Martinez [California] and on the northern flank of Monte Diablo.” He also incorrectly noted that the group may eventually prove to be worthy of ranking only as a subdivision of the Cretaceous Chico Group. In the same volume, Gabb (1869: 129) referred to the Martinez Group as “the upper portion of ‘Division A’ of the California reports.” These beds were provisionally demonstrated to be “Paleocene” age by Clark and Vokes (1936). Brice (1953) referred to Paleocene strata in Lake County, California, as Martinez Formation. He noted that “fossils characteristic of the Paleocene Martinez are found in scattered localities through the sandstone, and the lithologic assemblage is similar to that of the type Martinez formation.” Therefore, for the lack of a more appropriate name, the usage of Brice will be followed and these uppermost lower or lowermost upper Paleocene (Danian/Thanetian stages) beds in Lake County will be referred to as “Martinez” Formation.

CRESCENT FORMATION

The Crescent Formation of Arnold (1906: 460–461) was described for a “series black basalt and greenish basalt tuffs and tuffaceous sands found in the vicinity of Port Crescent,” Clallam County, Washington. Weaver (1937) referred to the Crescent Formation as middle Eocene (“Capay” California provincial molluscan stage [CPMS]) tuffaceous shales and sandstones and basaltic agglomerate of marine origin exposed on the northern flank of the Olympic Peninsula. Recently, much confusion has been ascribed to Eocene deposits near Maynard on Discovery Bay. Durlham (1944) referred

Table 1. List of the species of *Bernaya* (*Protoeypraca*), *Bernaya* sensu stricto, and *Eocypraca* sensu stricto from western North America and their generalized localities (formation is included for new species).

***Bernaya* (*Protoeypraca*) and *Bernaya* sensu stricto**

Late Cretaceous

- Bernaya* (*Protoeypraca*) *argonautica* (Anderson, 1958) [Jackson Co., Oregon]
B. (P.) berryessae (Anderson, 1958) [Yolo Co., California]
B. (P.) gualalaensis (Anderson, 1958) [Mendocino Co., California]
B. (P.) popenoci Groves, 2004 [Orange Co., California]
B. (P.) rincy Groves, 1990 [San Diego Co., California]
B. (Bernaya) beardi Groves, 2004 [Vancouver Id., British Columbia]
B. (B.) crawfordcatei Groves, 1990 [San Diego Co., California]
B. (B.) jeanac Groves, 2004 [Butte Co., California]

Eocene

- Bernaya* (*Protoeypraca*) *grovesi* Squires and Demetron, 1992 [Baja California Sur, Mexico]
Bernaya (*Bernaya*) *squiresi* new species [Crescent Formation, Jefferson Co., Washington]

***Eocypraca* sensu stricto**

Late Cretaceous

- Eocypraca* (*Eocypraca*) *louellae* Groves, 1990 [Yolo Co., California]

Paleocene

- Eocypraca* (*Eocypraca*) *novasumma* (Nelson, 1925) [Ventura Co., California]
Eocypraca (*Eocypraca*) *takeosusukii* new species ["Martinez" Formation, Lake Co., California]

Eocene

- Eocypraca* (*Eocypraca*) *batequensis* new species [Bateque Formation, Baja California Sur, Mexico]
Eocypraca (*Eocypraca*) *bayerquci* (Gabb, 1864) [Contra Costa Co., California]
Eocypraca (*Eocypraca*) *castacensis* (Stewart, 1926 [1927]) [Kern Co., California]
Eocypraca (*Eocypraca*) *crescentensis* new species [Crescent Formation, Thurston Co., Washington]
Eocypraca (*Eocypraca*) *jungoederti* new species [Crescent Formation, Lewis Co., Washington]
Eocypraca (*Eocypraca*) cf. *E. (E.) inflata* (Lamarck, 1802) [Kings Co., California]
Eocypraca (*Eocypraca*) *manibraensis* Squires and Advocate, 1986 [Riverside Co., California]
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to these beds as Eocene basalts, sandstones, shales, and small limestone lenses. Armentrout and Berta (1977) mentioned Narizian/Refugian benthic foraminiferal stages (late middle to late Eocene) aged foraminifera from a locality within the Townsend Shale Member of the Lyre Formation on the east side of Discovery Bay. Tabor and Cady (1978) mapped outcrops on the west side of Discovery Bay as a "sandstone and minor siltstone member" of the Lyre Formation, a younger unit than the Crescent Formation. Armentrout and others (1983) referred to these beds as "sandstone of Maynard" and proposed that it interfingers with the lower to middle Eocene upper Crescent Formation.

Most recently Speneer (1984) mapped the area as a "sedimentary member" of the Crescent Formation.

DOMENGINE FORMATION

Anderson (1905) described the "Domijeian Sands" for widespread outcrops on the north flank of Mt. Diablo, Fresno County, California and the type locality is in the NE¼ of section 17, north of Coalinga. The molluscan faunas were described by Clark and Vokes (1936) and Vokes (1939). These faunas became the basis of the "Domengine" [CPMS] of Clark and Vokes (1936), which they believed to be middle Eocene (Squires (1988)). Most recently, based on calcareous nannoplankton and magnetic stratigraphy, Prothero (2001) considered the formation to be early to middle Eocene age.

BATEQUE FORMATION

The Bateque Formation of Mina (1956, 1957) was named for outcrops along the Pacific side of Baja California, Mexico, from the north end and east side of Laguna San Ignacio to the San Juanico area about 105 km to the south (Squires and Demetron, 1992). The formation ranges in age from middle early Eocene to late middle Eocene ("Capay" [CPMS] through "Tejon" [CPMS]) based on calcareous nannoplankton, planktonic foraminifers, and mollusks (Squires and Demetron, 1992).

ABBREVIATIONS

Abbreviations used for institutional catalog and/or locality numbers, affiliations, and condensed terminology are as follows (unless indicated otherwise, collections are in California): CIT, California Institute of Technology, Pasadena (collections now at LACMIP); CPMS, California provincial molluscan stage; CSUN, California State University, Northridge (collections now at LACMIP); IGM, Instituto de Geología Universidad Nacional Autónoma de México, Mexico City; LACMIP, Natural History Museum of Los Angeles County, Invertebrate Paleontology Section; LACMVP, Natural History Museum of Los Angeles County, Vertebrate Paleontology Section; UCLA, University of California, Los Angeles (collections now at LACMIP); UCMP, University of California, Museum of Paleontology, Berkeley; USGS, United States Geological Survey, Menlo Park.

Measurement parameters are defined as follows: length = greatest distance between anterior and posterior ends; width = greatest distance between lateral margins; and height = greatest distance between base and dorsum.

SYSTEMATIC PALEONTOLOGY

The classification used here for Cypracidae follows that of Schilder and Schilder (1971) and Fehse (2001) for Eocypracidae.

Superfamily Cypraeoidea Rafinesque, 1815
 Family Cypraeidae Rafinesque, 1815
 Subfamily Bernayinae Schilder, 1927
 Tribe Bernayini Schilder, 1927

Genus *Bernaya* Jousseaume, 1884

Type Species: *Cypraea media* Deshayes, 1835, by original designation. Upper middle Eocene (Bartonian Stage), Auvers-sur-Oise, Val-d'Oise (northwest of Paris), France.

Diagnosis: Shell medium to large size; anterior end somewhat carinate; dorsum smooth; spire of medium height and partially covered; aperture wide, sides rounded; anterior and posterior canals deep; fossula smooth, concave, wide.

Remarks: Schilder and Schilder (1971) recognized 22 species and 11 subspecies of worldwide *Bernaya* sensu stricto. Four of their subspecies have been raised to specific status, one species and one subspecies have been reassigned to other genera, three species have been described subsequent to 1971 (see Groves, 1990; 2004), and another new species is described here. This brings the present total to 29 species and six subspecies. Only four of these species are from western North America (Table 1).

Subgenus *Bernaya* Jousseaume, 1884

Bernaya (*Bernaya*) *squiresi* new species
 (Figures 1–2)

B. (B.) n. sp. Groves, 1997: 7.

Diagnosis: *Bernaya* of large size, anterior and posterior canals deep, spire of medium height, fossula concave and smooth (although columellar dentition extends slightly onto fossula), posterior terminal ridges extend to margins.

Description: Shell of medium to large size, constricted anteriorly; maximum height of shell nearly centered; maximum width of shell slightly posterior of center; aperture wide, straight; dentition coarse to medium; columellar lip with 25 teeth, labral lip with 24 teeth; prominent anterior terminal ridges that form a slight marginal callus.

Comparison: The new species is unlike any other *Bernaya* from western North America. However, it does resemble *Bernaya obesa* (Deshayes, 1865) from the upper middle Eocene (Bartonian) of the Paris Basin, France, particularly the specimen figured by Cossmann and Pissarro (1911: pl. 32, fig. 162-1). The new species is less inflated, more constricted anteriorly, has a wider less sinuous aperture, and has finer dentition than *B. obesa*. Because the posterior terminal ridges are missing in *B. squiresi*, they cannot be compared; however, the anterior terminal ridges of *B. obesa* are more prominent than those of *B. squiresi*. A specimen identi-

fied as *B. (B.) obesa*, figured by Perrilliat and others (2003: 43, figs. 5–6) from the middle Eocene San Juan Formation, central Chiapas, southern Mexico, lacks enough shell material for adequate comparison to the new species.

Discussion: Post-burial crushing has damaged the anterior portion of the aperture and dorso-ventrally distorted the specimen. Generic and subgeneric assignment are based on the wide aperture, deep anterior and posterior canals, and medium-height spire. *Bernaya squiresi* represents the northernmost occurrence of the genus in Cenozoic strata and the only representative of the genus described from Washington.

Material: The new species is represented by a single fairly well preserved specimen that exhibits original shell material on the base and minor amounts of original shell material on the dorsum.

Type Material: Holotype LACMIP 13644, measures 52.7 mm in length, 40.0 mm in width, and 26.3 mm in height.

Type Locality: LACMIP loc. 22341 [ex UCLA loc. 2341], southwest end of Discovery Bay, Jefferson County, Washington. Middle lower Eocene ("Capay" [CPMS] = Ypresian Stage), Crescent Formation.

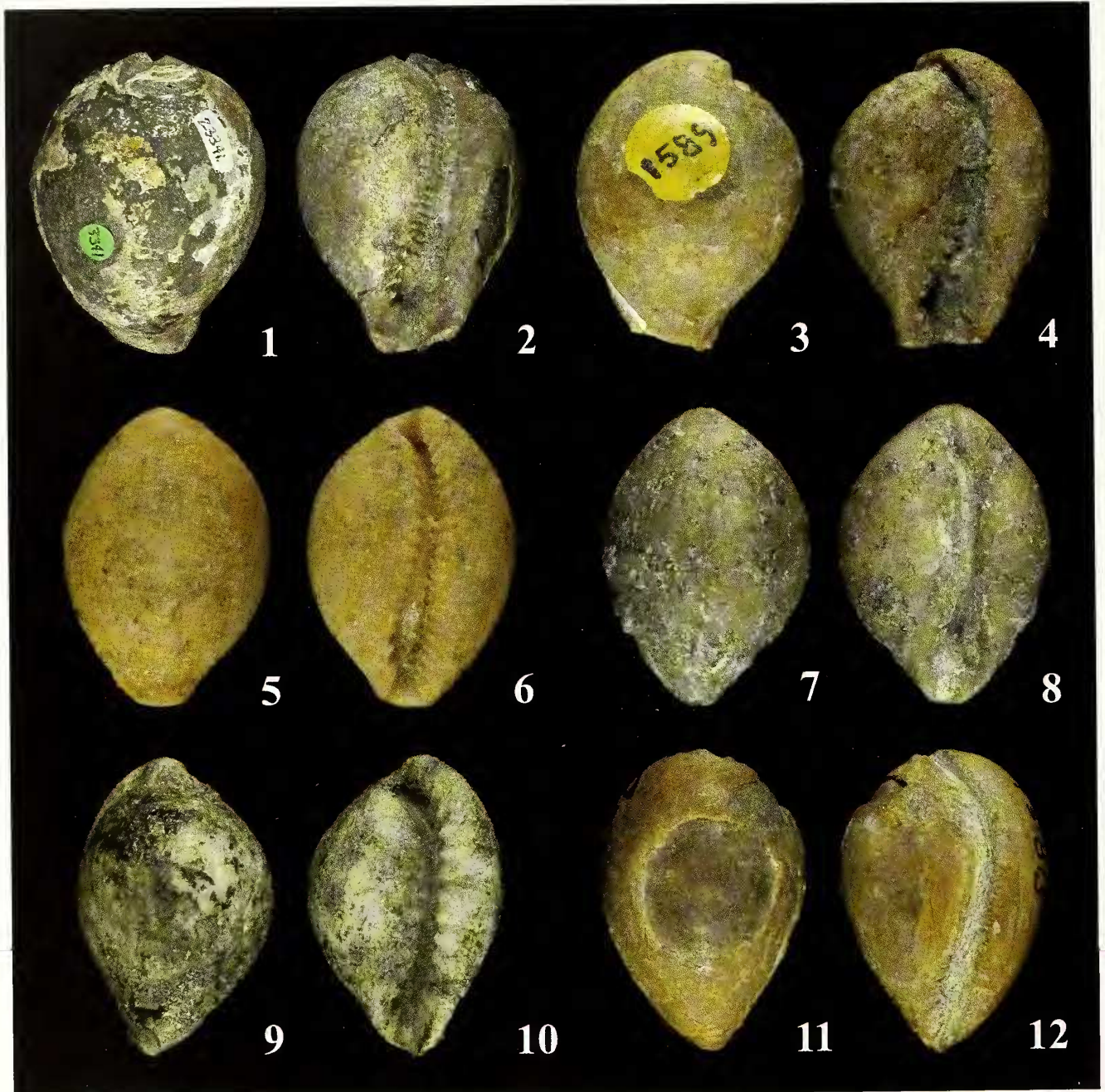
Etymology: This species is named after friend and colleague Richard L. Squires (CSUN Geological Sciences) for his extraordinary contributions to molluscan paleontology.

Family Eocypraeidae Schilder, 1924
 Subfamily Eocypraeinae Schilder, 1924
 Tribe Eocypraeini Schilder, 1924
 Genus *Eocypraea* Cossmann, 1903

Type Species: *Cypraea inflata* Lamarck, 1802, by original designation, middle Eocene (Lutetian/Bartonian stages), Paris Basin, France.

Diagnosis: Inflated-pyriform shell of small to medium size; spire involute; narrow elongate aperture; fossula broad, smooth, concave.

Remarks: Schilder and Schilder (1971) recognized 23 species and nine subspecies of *Eocypraea* sensu stricto. Six of their subspecies have been elevated to specific status, five species have been described subsequent to 1971, and four new species are described here which brings the total to 38 species and three subspecies. Nine of these species are from western North America (Table 1). Schilder (1924) established the subfamily Eocypraeinae for various genera of extinct and living cypraeids and ovulids including *Eocypraea* of Cossmann (1903). Schilder (1932) included *Eocypraea* in the family Amphiperatidae (= Ovulidae), subfamily Cypraeinae, but included fossil and living genera of ovulids



Figures 1–12. Paleogene cypraeoideans. 1–2. *Bernaya (Bernaya) squirei* new species, holotype LACMIP 13644, from LACMIP loc. 23341, 52.7 mm length. 3–4. *Eocypraea (Eocypraea) takcosusukii* new species, holotype LACMIP 13645 from LACMIP loc. 7045, 18.8 mm length. 5–6. *Eocypraea (Eocypraea) batequensis* new species, holotype IGM 5174 from LACMIP loc. 16951, 9.4 mm length. 7–8. *Eocypraea (Eocypraea) ereseentensis* new species, holotype LACMIP 13646, from LACMIP loc. 16655, 10.9 mm length. 9–10. *Eocypraea (Eocypraea) jimgoederti* new species, holotype LACMIP 13647, from LACMIP loc. 41573, 12.7 mm length. 11–12. *Eocypraea (Eocypraea)* sp., cf. *E. (E.) inflata* (Lamarek, 1802), hypotype UCMP 15815 from UCMP loc. A-1282, 27.1 mm length.

only. In 1971 Schilder and Schilder included the subfamily Eocypraeinae in the family Ovulidae and again included living and fossil genera. Fehse (2001) elevated Eocypraeinae to full family status (Eocypraeidae) but included only extinct genera.

Subgenus *Eocypraea* Cossmann, 1903

Eocypraea (Eocypraea) takcosusukii new species
(Figures 3–4)

E. (E.) n.sp. Groves, 1997: 7

Diagnosis: An *Eocypraea* with inflated shell and slightly s-shaped aperture.

Description: Shell moderately inflated, of medium size, constricted anteriorly; spire completely covered; dorsum highly arched; maximum height nearly center; maximum width nearly center; aperture slightly s-shaped and widens anteriorly, curves sharply toward columella posteriorly; denticulation semi-coarse with smooth interstices; outer lip with 16 teeth, inner lip with 11 teeth; fossula smooth, wide; all surfaces smooth; posterior columella highly inflated; posterior canal deep, anterior canal missing; anterior and posterior basal ridges slight and do not form basal calluses; base rounded.

Comparison: *Eocypraca* (*E.*) *takeosusukii* is unlike other eocypraeid in the eastern Pacific and is most similar to *Eocypraca bartlettiana* (Maury, 1912: 86–87, pl. 11, figs. 11–13) from the Paleocene (Thanetian Stage) of Soldado Roek, Trinidad, Trinidad and Tobago. The new species differs from *E. bartlettiana* by the lack of a prominent basal callus, coarser dentition, and more sinuous aperture.

Discussion: Good preservation of the holotype permits unequivocal generic assignment. *Eocypraca* (*E.*) *takeosusuki* differs from all other eocypraeids in the Western Hemisphere and is the first eocypraeid described from the “Martinez” Formation.

Material: The new species is represented by a single, moderately well preserved specimen exhibiting original shell material on its base and dorsum but with minor amounts of shell missing from the dorsum. The anterior end of the shell is missing.

Type Material: Holotype LACMIP 13645, measures 18.8 mm in length, 14.4 mm in width, 11.2 mm in height.

Type Locality: LACMIP loc. 7045 (*ex* CIT loc. I589), East of Lower Lake, Lake County, California, “Martinez” Formation.

Etymology: This species is named in honor of the late Takeo Susuki (*ex* UCLA) for his numerous important contributions to the study of invertebrate paleontology of southern California.

Eocypraca (*Eocypraca*) *batequensis* new species
(Figures 5–6)

Eocypraca? sp. Squires and Demetron, 1992: 31, figs. 77–79.

E. (*E.*) n. sp.1. Groves, 1997: 8.

Diagnosis: An *Eocypraca* with inflated shell and slightly s-shaped aperture.

Description: Shell moderately inflated, of small size, constricted anteriorly and posteriorly; spire covered; maximum height of dorsum slightly posterior of center; maximum width nearly center; aperture slightly s-shaped; denticulation semi-coarse with smooth interstices; outer lip with 24 teeth, inner lip with 18 teeth;

fossula smooth, wide; all surfaces smooth; anterior canal shallow, posterior canal deep; anterior and posterior terminal ridges short; slight basal marginal callus on outer lip; base rounded.

Comparison: The new species is unlike any known species in the eastern Pacific. However it somewhat resembles *Eocypraca inflata* (Lamarck, 1802) from the middle Eocene (Lutetian Stage) of Parnes, Oise Department, Paris Basin, France as illustrated by Cossmann and Pissarro (1911: pl. 32, fig. 162-7) and *E. cotteri* Cox (1930: pl. 19, figs. 8a–8c) from the late Paleocene (Thanetian Stage) of the Samana Range of northwest India. *Eocypraca* (*E.*) *batequensis* differs from both mainly by its smaller size but also by its narrower aperture, finer dentition, and less calloused outer lip.

Discussion: Excellent preservation of the holotype permits unequivocal generic assignment. *Eocypraca* (*E.*) *batequensis* differs from all other eocypraeids in the Western Hemisphere and is the first described from Baja California Sur, Mexico.

Material: Represented by a single well preserved internal mold.

Type Material: Holotype IGM 5174, measures 9.4 mm in length, 6.5 mm in width, and 5.1 mm in height.

Type Locality: LACMIP loc. 16951 (= CSUN loc. 1220b), Mesa La Salina, Baja California Sur, Mexico, Bateque Formation.

Etymology: This species is named for the Bateque Formation.

Eocypraca (*Eocypraca*) *crenscentensis* new species
(Figures 7–8)

E. (*E.*) n. sp. 2. Groves, 1997: 7 (in part).

Diagnosis: An eocypraeid with inflated shell and slightly s-shaped aperture.

Description: Shell moderately inflated, of small size; constricted anteriorly and slightly posterior; spire covered; maximum height slightly posterior of center; maximum width nearly center; aperture wide and very slightly s-shaped; denticulation coarse with smooth interstices; outer lip with 14 teeth, inner lip with 6 teeth; fossula smooth, wide; dorsal surface exhibits linear pattern which could represent growth lines; anterior and posterior canals shallow; anterior and posterior basal ridges reduced forming a slight collumellar basal callus; slight posterior spiral sulcus present; base rounded.

Comparison: *Eocypraca* (*E.*) *crenscentensis* n. sp. most closely resembles *E. (E.) jingocerti* n. sp. (this paper) but has a straighter aperture, a less prominent basal collumellar callus, more produced extremities, and a posterior spiral sulcus.

Discussion: Excellent preservation of the holotype permits positive generic assignment. *Eocypraea* (*E.*) *crenscentensis* differs from all other eocypraeids in the Western Hemisphere and is the first eocypraeid described from the Crescent Formation. The new species represents the northernmost record of the genus in western North America.

Material: The new species is represented by the fairly well preserved holotype specimen that exhibits original shell material and a poorly preserved topotypic internal mold that measures 7.8 mm in length, 5.6 mm in width, and 4.3 mm in height, and three small fragments

Type Material: Holotype LACMIP 13646, measures 10.9 mm in length, 7.6 mm in width, and 6.1 mm in height.

Type Locality: LACMIP loc. 16655 (*ex* CSUN loc. 1563), Larch Mountain, Thurston County, Washington, Crescent Formation.

Etymology: This species is named for the Crescent Formation, Washington.

Eocypraea (*Eocypraea*) *jimgoederti* new species
(Figures 9–10)

E. (E.) n.sp. 2. Groves, 1997: 7 (in part).

Diagnosis: An eocypraeid with inflated shell and slightly s-shaped aperture.

Description: Shell slightly inflated, of small size; constricted anteriorly and posteriorly and slightly produced; spire covered; dorsum highly arched; maximum height slightly posterior of center; maximum width nearly centered; aperture wide for size, slightly s-shaped; denticulation coarse with smooth interstices; outer lip with 14 teeth, inner lip with 12 teeth; fossula smooth and wide; all surfaces roughened by preservation; posterior columella moderately inflated; anterior canal shallow, posterior canal deep; anterior terminal ridges prominent, posterior terminal ridges slightly reduced; basal marginal callus moderate on outer lip; base rounded.

Comparison: *Eocypraea* (*E.*) *jimgoederti* new species is different from all other eocypraeids from the eastern Pacific but is somewhat similar to a specimen of *E. (E.) dollfusi* (Laubrière, 1881) from the middle Eocene (Lutetian Stage) of Parnes, Oise Department, Paris Basin, France as figured by Cossmann and Pissarro (1911: pl. 33, fig. 162-8). The new species has coarser dentition, straighter aperture, and has a less inflated columellar region than *E. (E.) dollfusi*.

Discussion: Good preservation of the holotype permits positive generic assignment. *Eocypraea* (*E.*) *jimgoederti* differs from all other eocypraeids in the

Western Hemisphere and is the second eocypraeid described from the Crescent Formation.

Material: The new species is represented by a single fairly well preserved specimen that exhibits original shell material.

Type Material: Holotype LACMIP 13647, measures 12.7 mm in length, 8.2 mm in width, and 6.9 mm in height.

Type Locality: LACMIP loc. 41573 (*ex* CSUN loc. 1573), Doty Hills, Lewis County, Washington, Crescent Formation.

Etymology: This species is named for colleague Jim Goedert, Gig Harbor, Washington, who collected the holotype and donated it to LACMIP and for his numerous important contributions to Tertiary molluscan paleontology of Washington.

Eocypraea (*Eocypraea*) sp., cf. *E. (E.) inflata* (Lamarck, 1802)
(Figures 11–12)

Eocypraea castacensis (Stewart, 1926 [1927]): Vokes, 1939: 26, 154, pl. 20, fig. 14.

Cypraea castacensis Stewart, 1926 [1927]: Ingram, 1942: 103, pl. 8, fig. 6.

Eocypraea (Eocypraea) moumieti Dolin and Dolin, 1983: 36; Groves, 1997: 8.

Remarks: The hypotype of Vokes (1939, pl. 20, fig. 14) [UCMP 15815] most closely resembles *E. (E.) inflata* (Lamarck, 1802) from middle Eocene strata (Lutetian/Bartonian stages) of France, Belgium, and England. This is particularly evident from the illustrations of Cossmann, 1903 (pl. 9, figs. 18–19) and Cossmann and Pissarro, 1911 (pl. 32, fig. 162-7). It also superficially resembles *E. (E.) maniobraensis* Squires and Advocate, 1986 from the lower Eocene ("Capay" [CPMS]) Maniobra Formation of Riverside County, California. *Eocypraea (E.) maniobraensis* is more elongate, has coarser dentition, has a prominent basal callus, and is significantly larger than *E. (E.)* sp. cf. *E. (E.) inflata*.

Vokes (1939) and Ingram (1942) both misidentified this poorly preserved specimen as *E. (E.) castacensis* (Stewart, 1926 [1927]). Most specimens of *E. (E.) castacensis* have a fairly prominent basal callus and it is less globose than *E. (E.)* sp., cf. *E. (E.) inflata*. Dolin and Dolin (1983) described *E. (E.) moumieti* from the Gan Basin, Pyrénées Atlantique Department, France. They included the hypotype of Vokes (1939) as this new species but did not refigure it. Dolin and Ledon (2002) tentatively reassigned *E. (E.) moumieti* to the eocypraeid genus *Sulcocypraea*. *Eocypraea (E.)* sp. cf. *E. (E.) inflata* differs from *E. (E.) moumieti* by its finer dentition and a slightly more inflated columellar region.

ACKNOWLEDGMENTS

Many thanks to Richard L. Squires (CSUN) and LouElla R. Saul (LACMIP) who reviewed an early draft of the manuscript and offered valuable comments and suggestions. Richard L. Squires (CSUN) collected the eocypraeid specimen from the Bateque Formation and made it available for study. María del Carmen Perrilliat (IGM) kindly loaned the Bateque Formation specimen. James L. Goedert (Gig Harbor, Washington and LACMVP Research Associate) collected the eocypraeid specimens from the Crescent Formation, made them available for study, and provided pertinent information regarding their stratigraphic occurrence. Special thanks to David Lindberg (UCMP) who loaned comparative material. The late Don McNamee (LACM Research Library) processed numerous interlibrary loans and assisted in the acquisition of several obscure references. Mary Stecheson (LACMIP) provided access to the LACMIP collection. Cathy L. Groves (LACM Echinoderms) and Brian Koehler (LACM Entomology Section) assisted with digital image manipulations. The thorough review of Charles L. Powell, II (USGS, Menlo Park, CA) is gratefully acknowledged.

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APPENDIX I. LOCALITIES CITED

LACMIP loc. 7045 [ex CIT loc. 1589]. 1200 ft. south of bridge over Herndon Creek on Monticello-Lower Lake Highway, 0.8 mile east of Lower Lake, Lake County, California. Latest early or earliest late Paleocene (Danian/Thanetian stages) "Martinez" Formation (uppermost "unnamed" [CPMS] or lowermost "Martinez" [CPMS]). Coll.: W.P. Popenoe, 12 May 1944.

LACMIP 16655 [ex CSUN 1563]. At elevation of 2230 ft. (680 m), exposed in roadcut on northeast side of logging road, latitude 47°59'3" N, longitude 123°8'12" W, 300 m north and 50 m east of southwest corner of sec. 1, T17N, R4W and 500 m S32E of Larch Mountain, U.S. Geological Survey, 7.5 minute, Capital Peak Quadrangle, provisional edition 1986, Black Hills, Thurston County, Washington. Upper part of the Crescent Formation. Age: Middle early Eocene ("Capay" [CPMS]). Coll. J.L. and G.H. Goedert, July, 1992 and September, 1997.

LACMIP 16951 [ex CSUN loc. 1220b]. Along a prominent ridge, north side of a minor canyon on the west side of Mesa La Salina, 84-130 m above the bottom of the Bateque Formation in this area, approximately 1.25 km southeast of the intersection of 113°00' W and 26°45' N, Mexican government topographic quadrangle map (1:50,000) of San José de Gracia (#G12A64), Baja California Sur, Mexico (1982 ed.). Coll.: R.L. Squires and R.A. Demetron, 1988.

LACMIP 23341 [ex UCLA 3341]. Southwest end of Discovery Bay, on Highway 101, 1000 ft. south of Maynard, sec. 23, T29N, R2W, Jefferson County, Washington. Middle early Eocene (Ypresian Stage), Crescent Formation ("Capay" [CPMS]). Coll.: H.C. Jamison and S.D. Conrad, April, 1952.

LACMIP 41573 [ex CSUN 1573]. In a "borrow pit" 228 m south and 548 m east of northwest corner of sec. 23, T14N, R5W, U.S. Geological Survey, 7.5 minute, Doty Quadrangle, provisional edition 1986, Lewis County, Washington. Crescent Formation. Age: Middle Eocene ("Domengine" [CPMS]). Coll. J.L. Goedert, 1993-1994.

UCMP A-1282. Approximately 100 feet below the uppermost fossiliferous layer, near the center of north edge of section 20, on hill slope immediately south of point where the Big Tar - McClure Rd. crosses saddle at head of stream running into McClure Valley, T23S, R17E, U.S. Geological Survey, 15 minute, Cholame Quadrangle, Kings County, California. Age: Middle Eocene ("Domengine" [CPMS]).